

WHAT SHOULD I LOOK FOR IN A POSTOPERATIVE BRACE?

Postoperative braces, or rehabilitative braces, are designed with unique characteristics that are required by patients that have been recently injured or have undergone an operative procedure. The brace must be worn continuously for periods ranging from two weeks to as much as six months when treating certain injuries. This requires the brace to be comfortable and breathable. The foam wrap material must provide adequate padding and be very breathable. Most braces do not have breathable foam. This can be a great problem in warm humid climates. The loop pile surface of most postoperative braces will stretch in one direction and be relatively non-stretch in the other direction. The non-stretch direction should wrap circumferentially around the leg to optimize support. Most postoperative brace manufacturers do not pay attention to the direction of this stretch.

The type of hinge utilized on a postoperative brace is not as critical as a functional brace. Most postoperative braces are used from full extension to between 90° and 100° of flexion. Therefore, single axis hinges are usually adequate for this purpose. It is not necessary to use polycentric or eccentric cam hinges on a postoperative brace. Since the hinge and arms are placed on the muscle tissue, and not attached to the bones, the hinge will be shifted slightly anterior to posterior from the thickening and thinning of the muscles as the knee flexes. A simple, single axis hinge only deviates from the true motion of the knee by about 1/4 inch from 0° to 90° of flexion. This is less than the ability of most medical professionals to accurately position the hinge, and is usually much less than the ability to maintain the hinge in the proper position.

Since injured or postoperative patients cannot adequately utilize their muscles, the brace must be capable of providing the requisite support on flaccid soft tissues. This means maximizing the leverage, or length, of the brace. It also means providing the appropriate amount of surface contact area. Every brace with a hinge is really two separate three-point lever systems that share the hinge center as their common third point. Each arm of the brace has two remaining points that contact the leg. Therefore, every brace with a hinge attaches to the leg by four

points. In order to optimize leverage and control, the two points of attachment on each arm should be as close to the knee and as far away from the knee as possible. Adjusting the brace length by moving all the straps away from the knee decreases control. Therefore, adjustable length braces should fix the position of the straps closest to the knee, while allowing the straps farthest from the knee to adjust away from the knee with the adjustable length arms. While adjusting requires a little more time during application, it provides the best possible control. If the medical professional does not wish to spend the time necessary to adjust or form the brace, a sized bracing system is a better choice provided that the inventory of three or four sizes causes no difficulty. If the medical professional wishes to utilize only one size brace, they must accept that suspension of the brace is more difficult, and there will be less control on patients with longer legs or more soft tissue.

The major goal of a postoperative brace is to provide adequate support and limited motion function to permit early mobilization of the injured limb. This necessitates the use of a hinge system that can be quickly adjusted to various ranges of limited motion or quickly locked at various positions. Since the shape of the leg is different on the medial and lateral sides of the leg, and there are overall differences in leg shape from patient to patient, the arms of the brace must be capable of being formed to fit the patient. This means the hinge arms must be formed and curved to lie flat on the curved sides of the leg. Some manufacturers design the hinge arms in a way that prevents proper forming to fit the patient. The hinges must be positioned parallel anterior to posterior and reasonably parallel in a vertical direction. Anatomy requires the tibial arm to be offset posteriorly from the femoral arm, and the hinge center offset about 3/4" posteriorly from the midline of the femoral arm. Not all manufacturers design their braces to accommodate the anatomy.

The hinge center must be capable of being placed in the appropriate position relative to the knee joint to permit motion without causing detrimental forces to the injured joint. The best anatomical structure to utilize for aligning the hinge center is the adductor tubercle on the medial side of the knee. The lateral hinge is placed visually in line with the medial hinge. The ability to place the hinge properly and maintain the proper placement is crucial. Out of place positioning can be detrimental. For instance, if the

hinge is allowed to slide distally on the leg, the brace will force the tibia anteriorly when the knee is flexed. This produces strain on an injured or reconstructed ACL. If the hinge center is placed anteriorly on the leg, the thigh section will be forced to slide distally during flexion. The thigh is cone shaped. After sliding down the cone, the thigh section will again grip the skin. Extension will now force the calf section to slide distally. A ratchet action is thus created which forces continued migration terminating with distal position. This migration now places stress on the ACL. Therefore, for most applications, the hinge should be placed a little superior and posterior of the ideal position.

It is necessary to provide proper suspension to maintain hinge position. There are several methods of accomplishing this goal. The most secure method is to utilize a shoe insert. However, this method is unpopular due to the discomfort and difficulty in using a shoe insert. The next best method is to suspend the brace from the ankle. This requires the brace to be length adjustable or available in sizes. The third method of suspension is to anchor the brace on the calf muscles just below the knee. On about 85% of the patients, the proximal calf muscles are slightly smaller in circumference than the mid-belly of the calf muscles. Most postoperative brace manufacturers do not adequately address proper suspension of their brace. They rely on skin friction and strap tension to maintain position. This is not a safe practice on a postoperative knee. Circulation can be inhibited and swelling will tend to force migration. All Bledsoe Braces feature some method of adequate suspension, proper hinge placement, and the ability to form the hinge arms to fit variations in each patient.

As the patient flexes and extends his leg against the motion limit stops, the leg forces are placed on the middle of each strap between the hinge arms. The strap must be capable of transmitting this stopping force to the hinge arms. This requires that the straps attach in some way to the hinge arms. There are various methods of accomplishing this goal. The straps can attach with hook and loop fastener material, or they can be permanently attached. Permanent attachment by riveting is very secure but forces the straps to be separately adjustable on their anterior and posterior halves. This has some benefit when attempting to place a counter shear force across the knee for ACL or PCL reconstructions, but requires fastening twice as many straps. Most brace manufacturers do not provide an adequate method of attaching the straps to the hinge arms. When the patient extends or

flexes against the stops, the hinge itself will stop. However, the leg continues moving and places force against the straps. This causes the straps to slide over the hinge arms or through slots on the hinge arms. The result is 20° or 30° of additional movement in each direction after the limit is reached. This is easily demonstrated by applying these braces and setting the hinge locked at 50°. It is possible in some braces to achieve 0° to 100° of movement.

Fitting time is another critical issue. A postoperative brace should be capable of being formed, fitted, and adjusted in less than five minutes. To accomplish this goal the packaging method is important. The brace should be packaged in a manner that permits the first item to be fitted as the first removed from the package. Many manufacturers force the professional to completely unfasten the device before application. This requires a lot of unnecessary time.

The final issue deals with patient compliance. The hinge adjustment should include a method to prevent the patient from tampering with the hinge setting if the doctor is concerned. Additionally, some patients are not reliable enough to leave their brace in position. Bledsoe Brace Systems offers large onetime closure bands that are routed through the D-rings of the straps around the ankle and just above the knee. This prevents the patient from removing the device against the physician's orders unless the bands are cut. If the patient will cut a band, he will remove a cast. Fortunately, most patients don't require this degree of control in order to comply with the doctor's wishes.

In summary, postoperative braces are a compilation of many design requirements. To function properly, they must be formable, breathable, quickly adjustable, anatomically designed, with maximum leverage, have a quick setting hinge, and straps that attach to the hinge arms for adequate control. If the physician wishes to maximize leverage or control, then an adjustable or sized bracing system should be chosen. If concern over stocking more than one size is the critical factor, a one size fits all bracing system may be utilized with slightly less support. Careful attention should be paid to attaching the straps to the hinge arms, the ability to form the brace to fit variations in leg anatomy, and quick easy adjustment of the hinge with the potential to address patient compliance.

There is a difference!

The difference is in the details!